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PATENT SPECIFICATION

419,756

Convention Date (United States): May 27, 1932.

Application Date (In United Kingdom): May 29, 1933. No. 15,482/33.

Complete Accepted: Nov. 19, 1934.

COMPLETE SPECIFICATION.

Improvements in Pneumatic Transport Systems.



I, JOSEPH ELLIOT KENNEDY, a citizen of the United States of America, of 258, Riverside Drive, in the Borough of Manhattan, in the City, County and State of New York, United States of America, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to means and a system for delivering material from a source of supply and transporting the same to a place remote from the source of supply for use or storage. While the invention is adapted particularly for the handling of pulverized material, such as coal, cement, and the like, it is also adapted for the handling of liquid or semi-liquid materials, such as slimes or slurries, as well as granular material, such as rye, wheat, oats, corn, flaxseed, and the like.

It is the primary object of the invention to provide an improved system and means for transporting material in suspension in a fluid, or by a fluid under pressure, from a source of supply to a remote place for use or storage.

The present invention consists in the provision of a container having a material outlet in the bottom with a conveying conduit connected thereto and a material inlet opening in the top, valve controlled connections with a source of fluid pressure leading into the lower portion of the container at a point within the outlet to effect an emulsifying of the material and to the top of the container to exert an extruding force upon the material in the container, said emulsifying and extruding pressure entered into the container constituting the sole conveying vehicle for the material through the conveying conduit and means to close the inlet opening adapted to have inlet closing movement imparted thereto by the fluid pressure entering into the top of the container and said fluid pressure exerting a force on said means in the closing position thereof to pressure seal the inlet.

The container closure means is provided with a globular face and closes outward from the container, and flexible means disposed about the inlet opening for said globular face to seat against and effect a wiping action when the closure means is moved to inlet sealing position thus assuring an intimate contact and a fluid tight seal between the globular face of the closure means and the flexible material. The closure means may also be provided with a sleeve extended rearward of the globular face, a casing in the container on which the sleeve of the closure means is slidable and guided toward and away from the inlet opening and to which the fluid pressure to the top of the container is connected, said casing opening to the sleeve and having ports covered by the sleeve in the inlet opening position of the closure means and uncovered by the sleeve in the inlet closing position of the closure means.

Means may be provided to manually move the closure means to and out of closing position and permit the closure means in closing position to have movement relative to the inlet opening by the material extruding pressure in the container to pressure seal said opening, and an auxiliary closure may be provided for the inlet opening exterior of the container to protect the inlet closure and sealing means from the elements and accumulation of foreign substances therein.

The container outlet is adapted for connection of a conveying conduit and the side wall is extended below the bottom and adapted for mounting the container and providing a compartment in which the valve controlling connections with the source of fluid pressure and connection for the conveying conduit are arranged and having an opening with a releasable closure.

The container has a flexible connection with a material storage bin, a valve to control the filling of material from the bin to the container, yielding means to support the container to have vertical movement calibrated to move the container with no load to predetermined position and permit of descending movement.

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ment of the container proportional with the quantity of material filled therein; and means rendered active when a predetermined quantity of material is filled into the container to actuate the material inlet control valve to shut off the flow of material from the bin to the container and actuate the fluid pressure control valve to connect the fluid pressure with the container; and after the material is discharged from the container actuate said latter valve to shut off the fluid pressure and actuate the material inlet control valve to permit of the flow of material to the container.

The invention also consists in the provision of a valve to control the outlet of the container and means rendered active to actuate said valve to open position when a predetermined quantity of material is filled into the container and to actuate the valve to outlet closing position after the material has been discharged from the container; and the providing of a connection from the container with the conveying conduit to exhaust the fluid pressure retained in the container after the discharge of a charge of material therefrom and displaced by the material filled therein; and valve mechanism to control said connection whereby to open the same to the container during the filling of the material therein and shutting off the same during connection of the container with the source of fluid pressure, and the provision of anti-friction guiding means for the container adapted to co-operate with the container supporting means to maintain and guide the container during the movement thereof in vertical direction.

In the drawings accompanying and forming a part of this specification Figure 1 is a side elevation of an embodiment of means for carrying out the invention.

Figure 2 is an elevational view of the means shown in Figure 1 showing in a diagrammatic manner the method of operation.

Figures 3 and 4 are side elevations, respectively, of a railway car and a motor truck showing the mounting of containers thereon embodying the invention.

Figure 5 is a longitudinal section, Figure 6 a cross section and Figure 7 a partial plan view in section of a scow illustrating an application of the invention thereto.

Figure 8 is a sectional view of a portion of the container and the pressure sealing closure means for the material inlet thereof.

Figure 9 is a sectional view showing a modified arrangement of the mounting

of the pressure sealed closure means for the material inlet opening of the container; and

Figure 10 is a sectional view of the portion of the container having the inlet opening and showing a further modified closure means for the opening.

In Figures 1 and 2 of the drawings there is illustrated an embodiment of means for automatically carrying out the invention and comprising a container 1 having a hopper or conical bottom with an outlet through the apex and having a flexible connection with a storage bin 2. The container is yieldingly supported to have vertical movement upon a supporting structure 12, mounted upon a foundation 13, by a series of springs 11, in the present instance three in number, equidistantly spaced about and interposed between the supporting structure and brackets 4, 5, 6 integral with or secured to and extending laterally from the container, the springs being retained in position by a spring washer 14 and stops 14^a. The springs are calibrated to move the container upward to a predetermined position with no load therein and have a predetermined downward movement proportional with the quantity of material filled into the container. On each of the brackets 4, 5, 6 there is mounted a carrier 7 for vertically spaced rollers 8, 9, to travel relative to vertical guides 10 fixed on the supporting structure to provide an anti-friction guiding means for the container in its movements and which co-operates with the supporting springs 11 to maintain the container in vertical position. The storage bin is attached by bolts 15 to a sleeve 16, and filling of the material from the bin into the container is controlled by a valve or gate 17 mounted on a shaft 18, whereby the valve is pivotally mounted in the sleeve 16, the shaft 18 having an actuating lever 19 fixed thereto.

The container has valve controlled connections with a source of fluid pressure, such as air or steam, to discharge the material from the container, and comprises a pipe 26 leading from the source of fluid pressure connected to a pipe 28 leading to the top of the container 1 by a flexible pipe or conduit 27a, with a valve 25 interposed in the connection of pipe 26 with the flexible pipe 27a, and the pipes 26, 28 having shut off valves 27, 29 interposed therein. The container also has a connection with the source of fluid pressure leading to the lower portion of the container, shown as a pipe 29a leading from the connection of pipes 27a, 28 and having branch pipes 32, 33, 34 leading therefrom into the

container, the pipe 34 leading to a coupling member 64, constituting a part of the container, and shown as an elbow for the connection of a material conveying conduit 68 with an interposed casing 65 for a valve 55 to control the container outlet, the conduit 68 being connected with casing 65 by a flexible pipe section 67. The connections of the branch pipes with the container are controlled by valves, shown in a conventional manner and indicated by 35, 36, 37; said valves being in the nature of spring influenced check valves closing outward from and opening into the container. The pipe 29a has a shut off valve 30 interposed therein and a pressure gauge 31. The fluid pressure entering the container through the branch pipes loosens and mixes with the material at the bottom or outlet end of the container thus effecting an aerating or emulsifying of the material, and the fluid pressure entering the top of the container exerts as extruding pressure upon the material in the container to supply the material for action thereon by the fluid pressure entering the container through the branch pipes and in conjunction therewith functioning to deliver the material from the container to the conveying conduit 68 and constituting the sole conveying vehicle for the material through the conveying conduit, and thus utilizing a minimum amount and volume of fluid pressure.

To efficiently discharge the material from the container by the extruding pressure and utilizing a minimum amount of pressure to extrude the material from the container and transport the material through the conveying conduit, it is essential that the container be substantially fluid pressure tight, and improved means is provided for pressure sealing the material inlet from the container. This means is in the nature of a valve having a globular or arcuate face 77 with a sleeve portion 76 rearward of the face whereby it is slidably mounted and guided upon a casing 71 mounted co-axially of the material inlet on channel members 72, 73 fixed in and extending transversely of the container and co-operating with the sleeve to form a chamber 82 in the sleeve to which the fluid pressure inlet pipe 28 leads. The closure means 76, 77 normally assumes a position away from the inlet opening, as indicated by dotted lines 83 in Figure 8, and supported by a laterally extending flange at the lower end of the casing 71 when in inlet opening position and the fluid pressure is shut off from the container, and in such position covering

ports 74, 75 through the casing wall communicating with chamber 82 and the container. When valve 17 is actuated to shut off the flow of material from the bin 2 to the container the fluid pressure is opened to the container and the connection of the pipe 28 being with chamber 82 forces the closure means 76, 77 toward the inlet opening of the container and retain it firmly seated against an annular member 79 of flexible material disposed about and extending radially inward from an opening in a plate 81 of the means to secure the flexible connection means of the storage bin 2 with the container and thus pressure sealing the material inlet from the container. The flexible member 79 is secured to plate 81 by a ring member and bolts, as at 80. In this position of the inlet sealing means the sleeve 76 of the closure means uncovers and opens ports 74, 75 to the container and permitting unobstructed admission of the fluid pressure into the container. The valve sleeve 76 has a loose fit with the casing whereby fluid pressure is adapted to be forced between the sleeve 76 of the closure means and casing to clear material therefrom. By the arrangement of the globular face 77 the closure means will conform itself to the seat 79 and as the closure means is moved to said seat there is effected a wiping of material from the globular face and seat which may have adhered thereto and thus assuring the fluid pressure tight sealing of the inlet opening. The marginal portion of the globular face 77 may be undercut, as at 78.

The outlet of the container may be provided with a valve, shown in the present instance in the nature of a flap valve 55 in the valve casing 65 to engage a seat at the connection of the valve casing with the connection member 64, the valve being pivotally supported, as at 56, and having an actuating arm 57 connected to its pivot support exterior of the casing 65.

To effect automatic operation of the apparatus; that is, the filling of a predetermined quantity of material into the container and the delivery of the same from the container in successive sequence, means are provided to actuate the valves for the material inlet and outlet and the admission of fluid pressure to the container controlled by the positioning of the container by its yielding supporting means 11 with no load in the container, and when a predetermined quantity of material is filled into the container. For this purpose fluid pressure operated means is provided, comprising a cylinder

20 mounted on sleeve 16 connecting the bin with the container and a piston 21 reciprocatory therein having an elongated rod 22 connected thereto and extended from the cylinder. The piston rod has a pin and slot connection 23 with the valve actuating lever 19 and has a trigger 24 fixed thereon consisting of a block with a laterally extending pin to engage a bifurcation in the end of an arm 25^a of the fluid pressure inlet control valve 25 to move said valve to open and closed position. The opposite ends of the cylinder are connected with a source of fluid pressure, a pipe 41 leading to one end of the cylinder from adjacent one end of a pilot cylinder 40 and a pipe 43 leading to the opposite end of cylinder 20 from adjacent the end of the pilot cylinder opposite to that to which the pipe 41 is connected, said pipes 41, 43 having control valves interposed therein. The pilot cylinder intermediate the ends is connected by pipe 39 with the pipe 26 leading from the source of fluid pressure. To control the connection of the opposite ends of the cylinder 20 with the source of fluid pressure through the pilot cylinder 40 reciprocatory piston mechanism is arranged therein, comprising three pistons heads 45^a, 45^b, 45^c fixed in equidistant spaced relation on a rod 45 one end of which is extended from one end of the pilot cylinder 40 and adapted to be actuated to connect either end of cylinder 20 through pilot cylinder 40 with the source of pressure, or open the same to the atmosphere through exhaust ports 40^a, 40^b in the pilot cylinder. In the position of piston 21 shown diagrammatically in Figure 2 with the valve 17 opening the material inlet to the container and valve 25 shutting off the fluid pressure from the container the one end of cylinder 20 is connected through pipe 41 with the source of fluid pressure through the space between piston heads 45^a, 45^b, while the opposite end of cylinder 20 is open to the atmosphere through pipe 43 and the exhaust ports 40^b in pilot cylinder 40 and communicating with the space between the piston heads 45^b, 45^c. To connect cylinder 20 through pipe 43 with the source of actuating fluid to actuate the piston 21 to move valve 17 to closing position and the valve 25 to open position the pilot pistons are adjusted to connect pipe 39 and pipe 43 with the space between the piston heads 45^b, 45^c shutting off pipe 39 from the space between piston heads 45^a, 45^b and opening said space to the ports 40^a. The pilot piston mechanism is actuated to the position shown in Figure 2 when the container is empty

and moved to predetermined upward position by its supporting springs 11 causing an abutment 48, adjustably carried by a bracket 49 fixed to the container, to engage one arm of a pivoted lever 46, the other lever arm being connected with the piston rod 45. When a predetermined quantity of material is filled into the container and downward movement is imparted to the container against the tension of the container supporting springs 11 an abutment 47 adjustably carried by the bracket 49 opposed to the abutment 48 is caused to engage the lever 46 and adjust the pilot piston mechanism to open the pipe 39 and the pipe 43 to the space between the pistons 45^b, 45^c and opening the space between pistons 45^a, 45^b with the pipe 41 and the exhaust ports 40^a, thus connecting the cylinder 20 with its actuating fluid source to move it to the end opposite to that shown in Figure 2, actuating the valve 17 to closed position and the valve 25 to open position and connecting the container with the source of pressure.

Means are also provided to actuate the outlet control valve 55 to outlet closing position when valve 17 is in open position and valve 25 is in closed position, as shown in Figure 2, and to open position when valve 17 is actuated to closed position and valve 25 to open position. This means is herein shown as comprising fluid pressure operated means for which purpose there is provided a cylinder 54, a piston 60 reciprocatory therein having a rod 59 connected thereto and extended from the cylinder and having a pin and slot connection 58 with the valve actuating lever 57. One end of the cylinder is connected by pipe 52 through a flexible pipe section 51 with pipe 50 and thereby through pipe 43 with the pilot cylinder 40. The opposite end of cylinder 54 is connected by pipe 62 through flexible pipe section 61 with pipe 41 and thereby with the pilot cylinder 40. The pipe sections 52, 62 have control valves 53, 63 interposed therein.

To exhaust the fluid pressure retained in the container when valve 25 is closed and during the filling of material into the container a valve controlled exhaust outlet leads from the top of the container having a pipe 69 connected thereto and may have a pressure gauge 70 interposed in the connection. In a closed system the pipe 69 is connected with the conveying conduit 68, and for this purpose said pipe is connected with the valve casing 65 at the outer side of valve 55, and said valve is adapted to control said connection of pipe 69 against which valve 55

seats when moved to container outlet opening position.

In Figure 9 there is shown a modified structure of the closure means to pressure seal the material inlet, the structure being the same as that shown in Figure 8 except that a plunger 84 having a tapered end 85 is secured axially of the valve sleeve 76 by extending a reduced threaded end through the globular wall and secured by a nut 86, the plunger being adapted to engage in the portion of the fluid pressure inlet pipe 28 connected with the casing 72, whereby the fluid pressure will act initially on said plunger to move the closure means to the material inlet, the plunger being of a length so that it will clear the pipe 28 when the closure means is in inlet closing position.

In Figure 10 there is shown a further modification of the inlet closing and sealing means 87 adapted to be manually moved to closing and opening positions and adapted to engage a seat 88 of flexible material secured to the flange 90 extended into the material inlet from an annulus 89 secured on the container by screws 89a. The valve is manually drawn to the seat 88 by a threaded stud extending into the closure and loosely extending through an opening in a hub 92 integral with a spider 91 extended inward from the annulus flange 90, the stud having a nut 95 provided with hand grips 96, 97 threaded thereon exterior of the hub 92 and whereby the closure is drawn to the seat 88. This closure means is particularly adapted for use with containers to be mounted on transporting means, such as railway cars, motor trucks or scows, where the material is filled into the container at the source of supply and then transported by the transporting means to a remote place when the material is discharged from the container under fluid pressure as hereinbefore described. To seal the closure means from the elements and prevent accumulation of foreign substances thereon during transportation of the container closure means is provided therefor comprising a dome shaped cover 97a hinged at 98 to the annulus 89 and provided with a staple 99 to engage a hasp 100 and adapted for the engagement of the hasp of a padlock 101. The cover has a hand grip 102 to facilitate moving the cover to opening and closing positions.

In Figure 3 a series of four containers 104, 105, 106, 107 are shown mounted on a railway car 103, and in Figure 4 two containers 131, 132 are shown mounted on a motor truck 133, to be transported thereby. The construction,

arrangement and mounting of the containers on the car and truck are the same and description of one is, therefore, deemed to suffice for the two. The containers are provided with eye members 108 whereby they may be removed from the transporting means. To secure the containers to the car or truck a series of angle members 109 are fixed thereto having tie rods fixed therein extended through openings in angle brackets 111 secured to the containers and nuts threaded onto the tie rods, as at 110. The side wall of the containers is extended below the hopper bottom 116 of the containers to serve as a support for the containers and provide a compartment 117 within which the control valves 118, 119 and connections 120, 120a are arranged, the extended wall having an opening with a releasable closure 121 hinged at 122, 123 and provided with a conventional form of sealing means 124. A pipe 120^a adapted for connection with a source of fluid pressure is provided with a closure cap 120ⁱ, and branch pipes 120^b, 120^c, 120^d leading from said pipe 120^a to the lower portion of the container and having check valves 120^e, 120^f, 120^g closing outward from and opening into the container to effect an aerating or emulsifying of the material in the container at the outlet. A pipe 127 connected with pipe 120^a leads through the wall of the container to adjacent the top of the container, as at 129, for admitting material extruding pressure into the container. If desired, the pipe 127 may have a separate connection, as shown at 130^a, with the source of fluid pressure in which case the inlet to pipe 127 is provided with a closure cap 130. The material outlet 125 of the containers is provided with a closure cap 126 adapted to be removed for connection of a transporting conduit, as shown at 126^a.

In Figures 5, 6 and 7 there is shown a scow 134 in a conventional manner having the interior 135 arranged as a container the bottom walls of which converge from intermediate the sides and terminating at a tubular casing in which there is arranged a screw conveyor 137, communication with said casing being through openings 136 provided with valves or gates 136^a, through which openings the material flows from the container to the conveyor casing and fed by the screw conveyor to a hopper 138 from which the material is transferred by an elevator 139 into the container of the material transporting means, indicated at 140, the material conveying conduit connected with the outlet of the container leading through the top of the

scow, as at 141, the container being provided with the control means for admitting and discharging the material and for the admission of the aerating or emulsifying and extruding fluid pressure.

The apparatus is in the nature of a weighing mechanism since loads of predetermined quantity and weight are filled into and discharged from the container in successive sequence, and a register may be provided actuated from the movement of the container by the filling of each load into the container to register the number of loads filled into and discharged from the container, and as the successive loads are of predetermined weight the successive loads may be totalized by multiplying the number of loads by the weight thereof.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. In material transporting means, a container having a material outlet in the bottom with a conveying conduit connected thereto and a material inlet opening in the top, valve controlled connections with a source of fluid pressure leading into the lower portion of the container at a point within the outlet to effect an emulsifying of the material and to the top of the container to exert an extruding force upon the material in the container, said emulsifying and extruding pressure entered into the container constituting the sole conveying vehicle for the material through the conveying conduit and means to close the inlet opening adapted to have inlet closing movement imparted thereto by the fluid pressure entering into the top of the container and said fluid pressure exerting a force on said means in the closing position thereof to pressure seal the inlet.

2. Material transporting means as claimed in claim 1, wherein the container closure means has a globular face and closes outward from the container, and flexible means disposed about the inlet opening for said globular face to seat against and effect a wiping action when the closure means is moved to inlet sealing position.

3. Material transporting means as claimed in claims 1 and 2, wherein the closure means has a sleeve extended rearward of the globular face, a casing in the container on which the sleeve of the closure means is slidable and guided toward and away from the inlet opening and to which the fluid pressure to the top of the container is connected, said casing opening to the sleeve and having

ports covered by the sleeve in the inlet opening position of the closure means and uncovered by the sleeve in the inlet closing position of the closure means.

4. In material transporting means as claimed in claims 1 and 2, the provision of means to manually move the closure means to and out of closing position and permit the closure means in closing position to have movement relative to the inlet opening by the material extruding pressure in the container to pressure seal said opening.

5. Material transporting means as claimed in claim 1, 2 and 4, wherein an auxiliary closure is provided for the inlet opening exterior of the container to protect the inlet closure and sealing means from the elements and accumulation of foreign substances therein.

6. Material transporting means in accordance with claims 1 to 5, wherein the container outlet is adapted for connection of a conveying conduit and the side wall is extended below the bottom and adapted for mounting the container and providing a compartment in which the valve controlling connections with the source of fluid pressure and connection for the conveying conduit are arranged and having an opening with a releasable closure.

7. Material transporting means as claimed in claims 1 or 2 and 3, wherein the container has a flexible connection with a material storage bin, a valve to control the filling of material from the bin to the container, yielding means to support the container to have vertical movement calibrated to move the container with no load to predetermined position and permit of descending movement of the container proportional with the quantity of material filled therein, and means rendered active when a predetermined quantity of material is filled into the container to actuate the material inlet control valve to shut off the flow of material from the bin to the container and actuate the fluid pressure control valve to connect the fluid pressure with the container, and after the material is discharged from the container actuate said latter valve to shut off the fluid pressure and actuate the material inlet control valve to permit of the flow of material to the container.

8. Material transporting means as claimed in claim 7, wherein the means to actuate the material and pressure inlet control valves, comprises a cylinder having a valve controlled connection to opposite ends with a source of fluid pressure, and a reciprocatory piston in said cylinder having a rod connected

thereto extended from the cylinder and operatively connected with the material inlet control valve and means for connection with and to actuate the fluid pressure control valve.

9. Material transporting means as claimed in claims 7 or 8, wherein the container has a flexible connection with the conveying conduit and a valve to control the material outlet of the container, and means operative when a predetermined quantity of material is filled into the container to actuate said valve to outlet opening position and when the material is discharged from the container actuate said valve to outlet closing position.

10. Material transporting means as claimed in claim 9, wherein the means to actuate the outlet control valve comprises a cylinder having a valve controlled connection to the opposite ends with a source of fluid pressure, and a reciprocatory piston in said cylinder having a rod connected thereto extended from the cylinder and operatively connected with the valve.

11. Material transporting means as claimed in claims 7 and 8 or 9 and 10, wherein the connections of the source of fluid pressure with the cylinders of the actuating means for the fluid pressure, material inlet and outlet control valves comprises a pilot cylinder connected with the source of fluid pressure and having connections with opposite ends of the cylinders, reciprocatory piston mechanism in the pilot cylinder operative to connect the source of pressure with one end of the cylinders while shutting off the opposite ends from the source of fluid pressure and connecting the same to the atmosphere, and means operative to actuate said piston mechanism when the container is moved upward to predetermined position by its yielding support to connect the fluid pressure with one end

of the cylinders and when the container assumes a predetermined position by the weight of material filled therein connect the fluid pressure with the opposite end of the cylinders.

12. Material transporting means as claimed in claims 7 to 11, wherein the container has an outlet from the top to exhaust fluid pressure retained in the container when it is shut off from the source of fluid pressure and material is filled into the container.

13. Material transporting means as claimed in claim 12, wherein the exhaust outlet is connected with the conveying conduit, and a valve operative to shut off said connection when the fluid pressure is connected with the container and open said connection when the fluid pressure is shut off from the container and material is filled into the container.

14. Material transporting means as claimed in claim 12, wherein the exhaust outlet from the container is connected with the conveyor conduit, and the container outlet control valve is adapted to shut off said connection when in container outlet opening position and open said connection when said valve is in container outlet closing position.

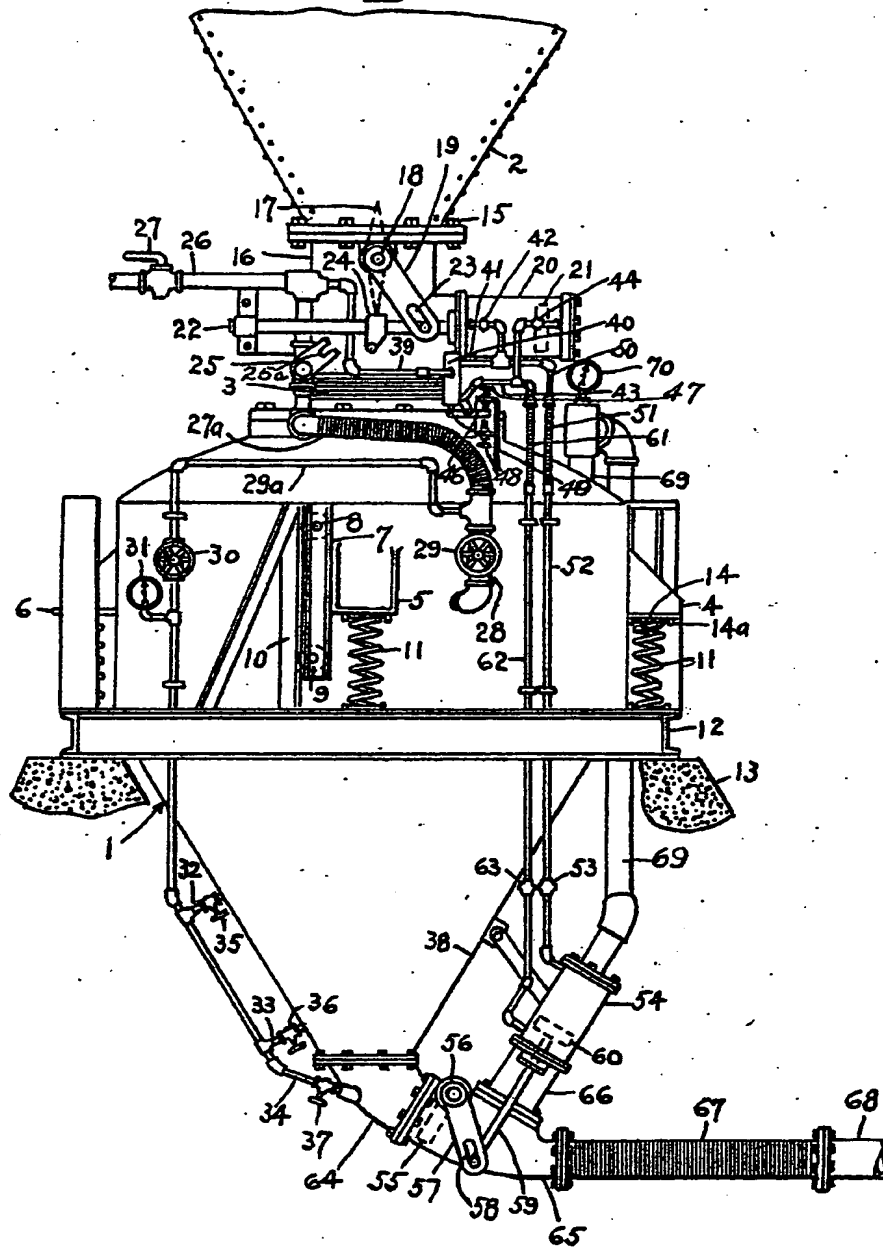
15. Material transporting means as claimed in claims 7 or 8 to 14, the provision of anti-friction guiding means for the container adapted to co-operate with the yielding support to maintain the container during the movement thereof in vertical position.

16. Material transporting means substantially as described with reference to the accompanying drawings.

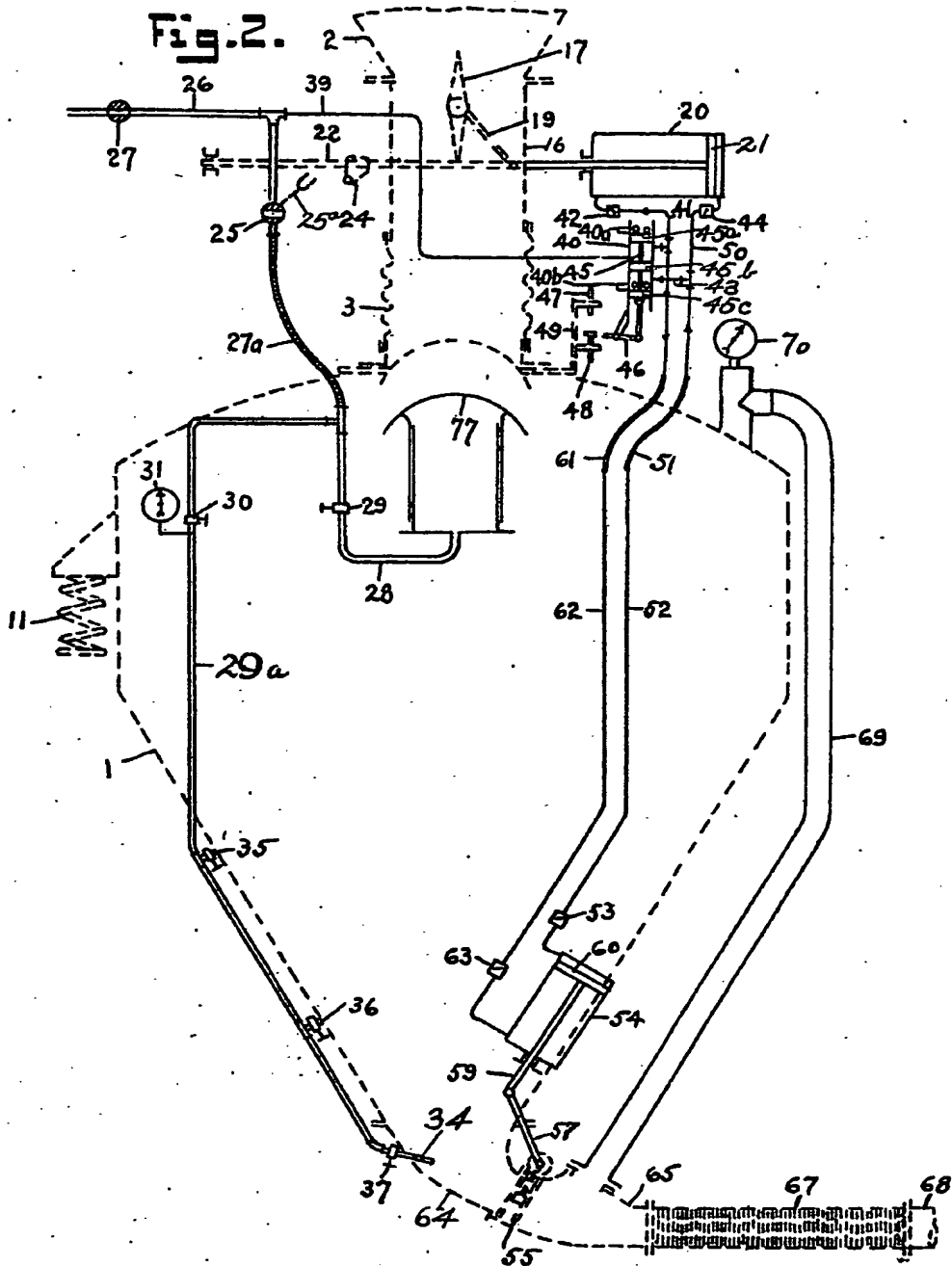
Dated this 29th day of May, 1933.

For the Applicant,
HERBERT HADDAN & Co.,
Chartered Patent Agents,
31 and 32, Bedford Street, Strand,
London, W.C.2.

Fig. 1.



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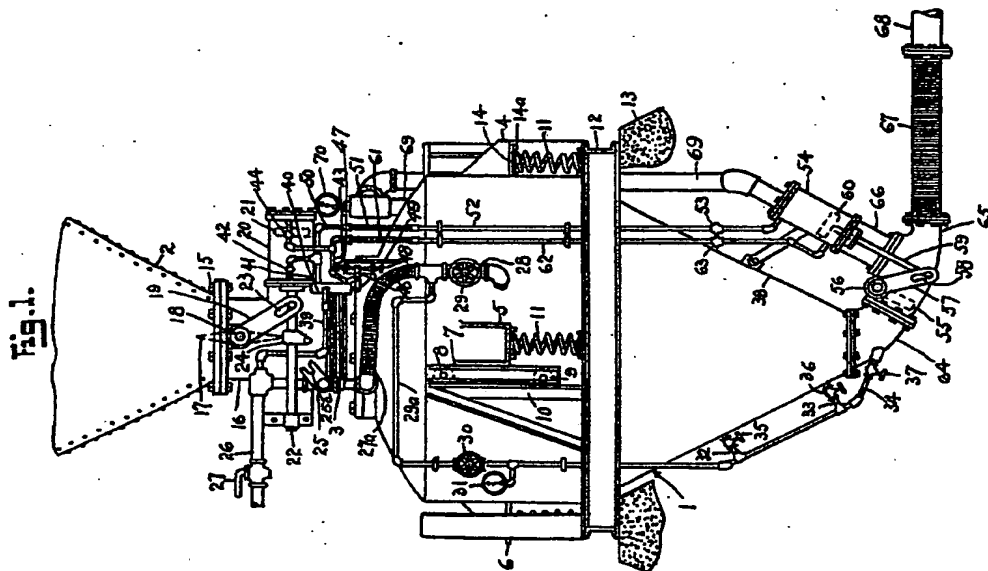


Fig. 1.

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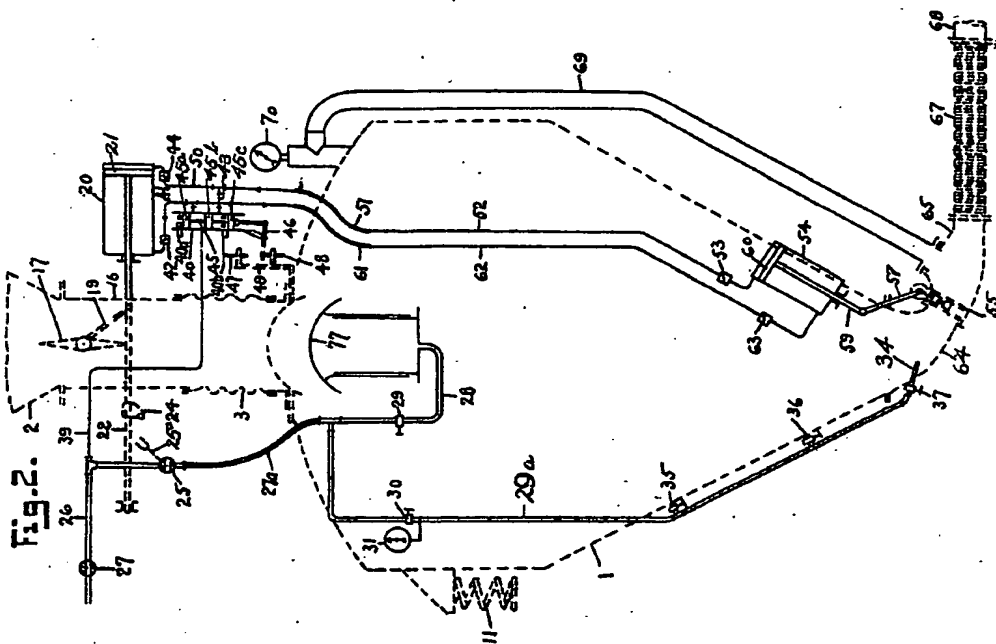


Fig. 2.

Fig. 3.

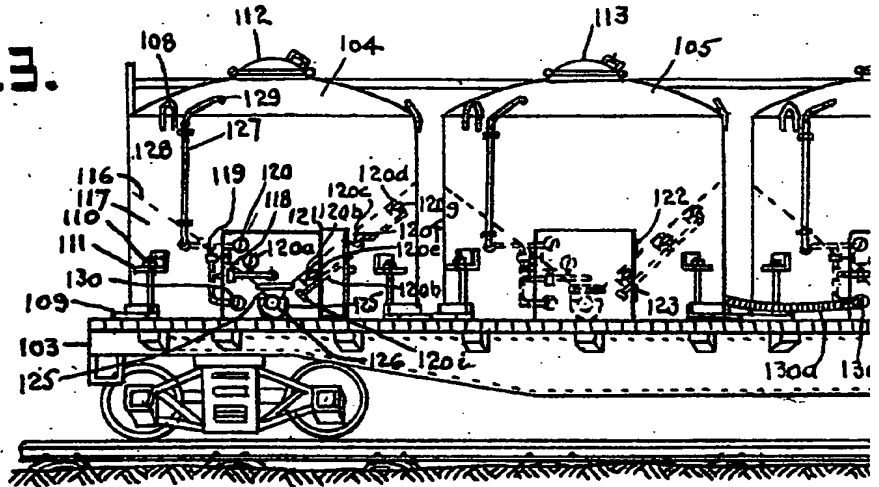
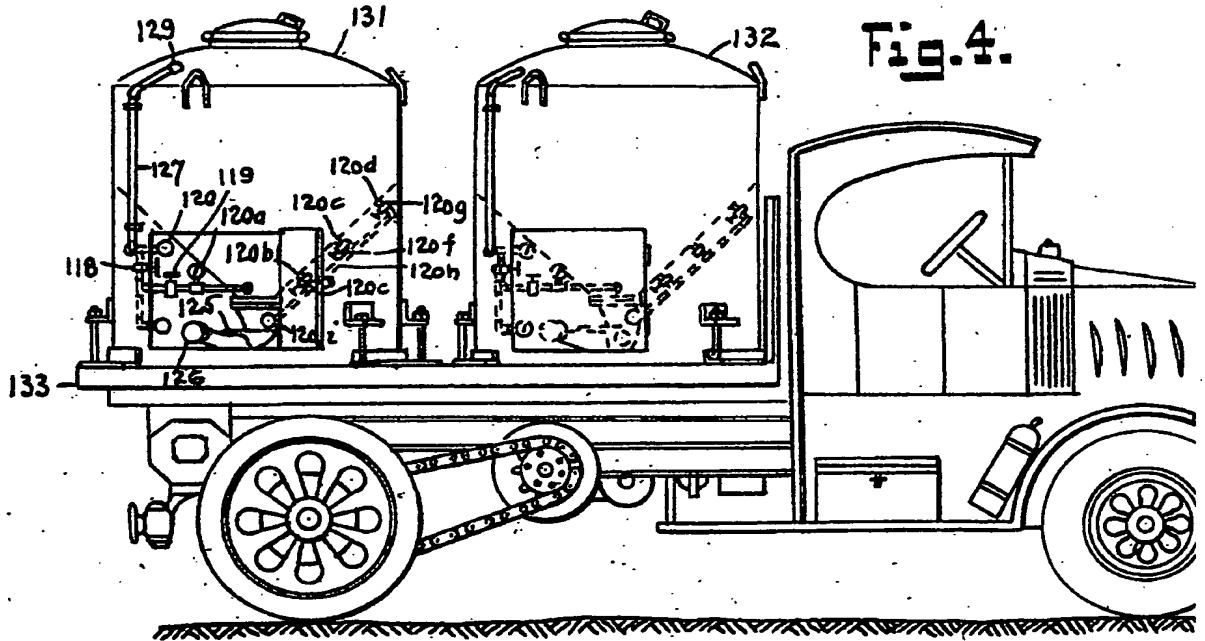


Fig. 4.



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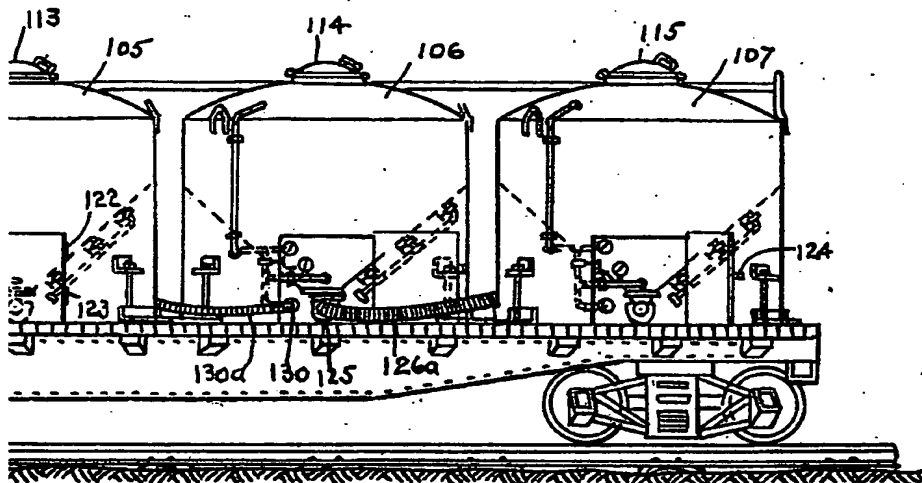


Fig. 5.

Fig. 4.

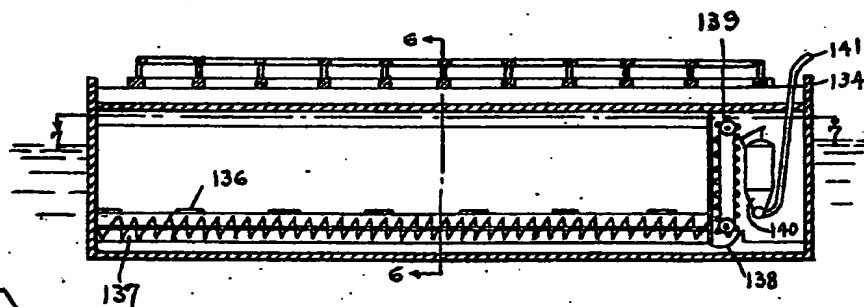
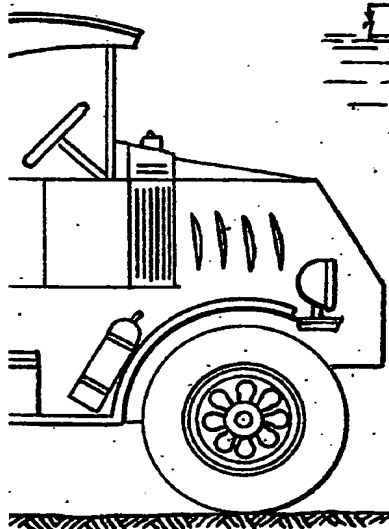
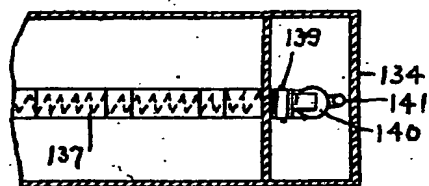
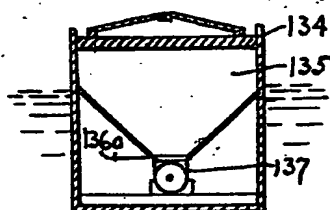


Fig. 6.

Fig. 7.



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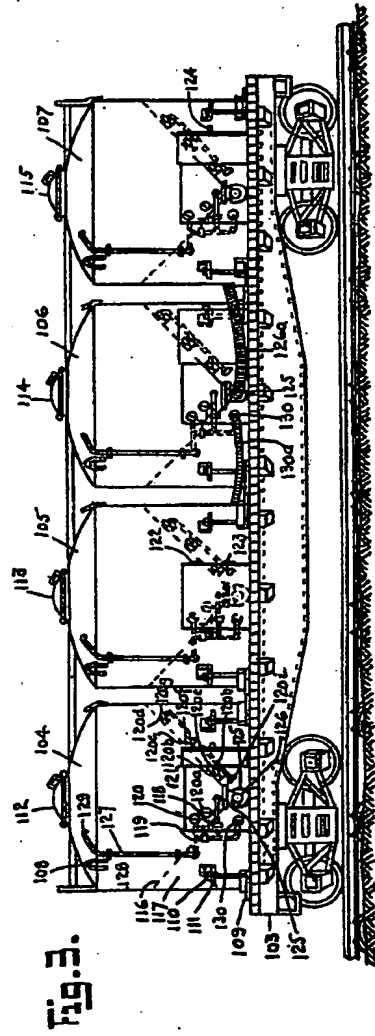


Fig. 3.

Fig. 5.

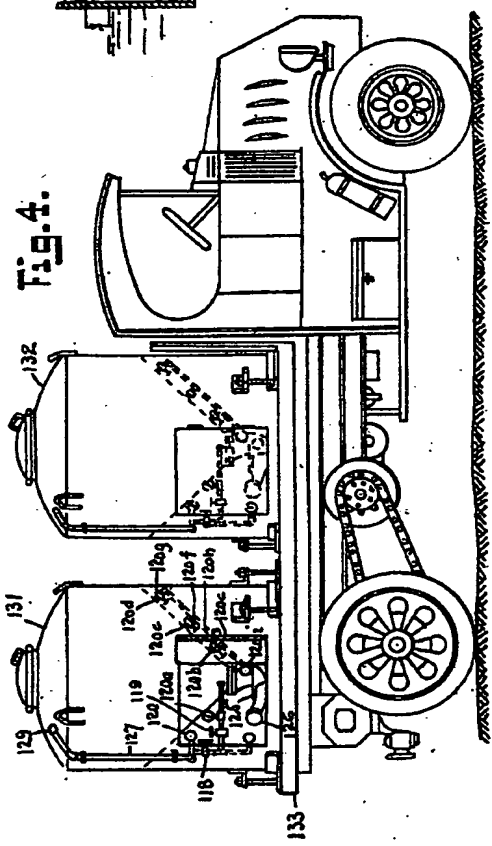
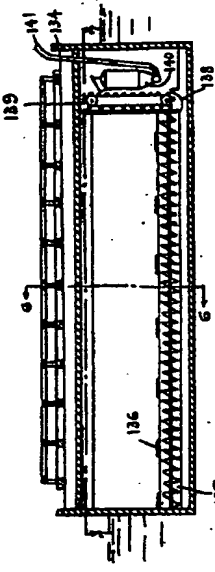


Fig. 4.



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